

WHAT IS CLAIMED IS:

1 1. An internal combustion engine, comprising:
2 a main section defining an intake port leading to a
3 cylinder of the engine;
4 an intake valve arranged to open and closet a
5 downstream port end of the intake port; and
6 a flow regulating section to regulate an intake air
7 flow in the intake port into the cylinder, the flow regulating
8 section including;
9 a partition extending in the intake port in a
10 longitudinal direction of the intake port from an upstream
11 end to a downstream end, and dividing the intake port into
12 first and second passage sections;
13 a gas motion control valve located by the upstream
14 end of the partition, to open and close the second passage
15 section;
16 a connection passage formed near the gas control
17 valve, to connect the first and second passage sections,
18 and to allow recirculation flow of intake air in the second
19 passage section from the second passage section to the
20 first passage section when the second passage section is
21 closed by the gas motion control valve; and
22 a bulge formed in a first part of a circumferential
23 region surrounding the downstream port end of the intake
24 port on a side near the second passage section.

1 2. The internal combustion engine as claimed in Claim 1,
2 wherein the flow regulating section is arranged to decrease
3 an intake air stream flowing into the cylinder through a
4 first opening region between the intake valve and the first
5 part of the circumferential region and to increase an intake

6 air stream flowing into the cylinder through a second open
7 region between the intake valve and a second part of the
8 circumferential region diametrically opposite to the first
9 part when the second passage section is closed by the gas
10 motion control valve; and the bulge extends around the
11 downstream port end only in the first part of the
12 circumferential region surrounding the downstream port
13 end of the intake port.

1 3. The internal combustion engine as claimed in Claim 1,
2 wherein the second passage section is located under the
3 first passage section in an up-down direction of the cylinder
4 of the engine; and the second open region is located at a
5 radial inner position, and the first open region is located at
6 a radial outer position which is remoter from an axis of the
7 cylinder than the second open region; and wherein the
8 bulge is projected so as to restrain reverse flow of fluid
9 from an inside of the cylinder into the second passage
10 section of the intake port when the second passage section
11 is closed by the gas motion control valve.

1 4. The internal combustion engine as claimed in Claim 1,
2 wherein the bulge is formed in an inside wall surface of a
3 combustion chamber of the cylinder.

1 5. The internal combustion engine as claimed in Claim 4,
2 wherein the bulge bulges inward in the combustion
3 chamber from a combustion chamber reference plane.

1 6. The internal combustion engine as claimed in Claim 4,
2 wherein the bulge bulges downward in the combustion
3 chamber from an upper wall surface of the combustion
4 chamber so as to form a squish area in the combustion
5 chamber.

1 7. The internal combustion engine as claimed in Claim 5,
2 wherein the combustion chamber is of a pent-roof type,
3 and the bulge bulges inward in the combustion chamber
4 from the combustion chamber reference plane on the intake
5 side of the combustion chamber of the pent-roof type.

1 8. The internal combustion engine as claimed in Claim 1,
2 wherein the bulge is formed in an inside wall surface of the
3 intake port, and the bulge bulges into the downstream port
4 end.

1 9. The internal combustion engine as claimed in Claim 2,
2 wherein the intake port terminates with two of the
3 downstream port ends opening into a combustion chamber
4 of the cylinder; the cylinder of the engine is provided with
5 two of the intake valves to open and close the downstream
6 port ends, respectively; and the bulge is formed in the first
7 part of the circumferential region of each of the
8 downstream port ends of the intake port.

1 10. The internal combustion engine as claimed in Claim 9,
2 wherein the bulge is formed in a region between the
3 downstream port ends of the intake port and an outside
4 boundary of the combustion chamber.

1 11. The internal combustion engine as claimed in Claim 9,
2 wherein the second passage section is located under the
3 first passage section in an up-down direction of the cylinder
4 of the engine; and a combustion chamber of the cylinder is
5 of a pent-roof type, and the bulge bulges inward in the
6 combustion chamber from a combustion chamber reference
7 plane on the intake side of the combustion chamber of the
8 pent-roof type.

1 12. The internal combustion engine as claimed in Claim 9,
2 wherein the intake port includes two downstream branches
3 leading to the downstream port ends, respectively, and the
4 bulge is formed in an inside wall surface of each
5 downstream branch of the intake port.

1 13. The internal combustion engine as claimed in Claim 1,
2 wherein the connection passage is in the form of an
3 interspace between the upstream end of the partition and
4 the gas motion control valve in a closed position closing the
5 second passage section.

1 14. The internal combustion engine as claimed in Claim 1,
2 wherein the connection passage is opened in the partition.

1 15. The internal combustion engine as claimed in Claim 1,
2 wherein the gas motion control valve is arranged to reduce
3 an open sectional area of the intake port to produce a low
4 pressure region in the first passage section of the intake
5 port; and the connection passage connects an upstream

6 end portion of the second passage section to the low
7 pressure region produced in the first passage section to
8 promote recirculating flow of intake air in the second
9 passage section from a downstream end of the second
10 passage section to the upstream end portion of the second
11 passage section, and from the upstream end portion to the
12 first passage section when the second passage section is
13 closed by the gas motion control valve.

1 16. An intake apparatus for an internal combustion
2 engine, comprising:
3 first means for defining a combustion chamber and
4 an intake port leading to the combustion chamber;
5 second means for dividing the intake port into first
6 and second passage sections extending in a longitudinal
7 direction of the intake port;
8 third means for closing an upstream end of the
9 second passage section and forming a low pressure region
10 in the first passage section;
11 fourth means for drawing intake air from a
12 downstream end of the second passage section through the
13 second passage section to the low pressure region in the
14 first passage section when the upstream end of the second
15 passage section is closed; and
16 fifth means for restraining a reverse flow of fluid
17 drawn from the combustion chamber into the second
18 passage section of the intake port.